(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 0 581 284 B2

(12) **NEW EUROPEAN PATENT SPECIFICATION**

(45) Date of publication and mention of the opposition decision:
23.05.2001 Bulletin 2001/21

(45) Mention of the grant of the patent:
29.10.1997 Bulletin 1997/44

(21) Application number: **93112171.9**

(22) Date of filing: **29.07.1993**

(51) Int Cl.7: **H01L 23/538**, H01L 23/498, G06K 19/07

(54) **Non-contact IC card and manufacturing and testing methods of the same**

Kontaktlose IC-Karte sowie deren Herstellungs- und Prüfverfahren

Carte à circuit intégré sans contact et son procédé de fabrication et d'examen

(84) Designated Contracting States:
DE FR GB

(30) Priority: **30.07.1992 JP 20372492**

(43) Date of publication of application:
02.02.1994 Bulletin 1994/05

(73) Proprietor: **MITSUBISHI DENKI KABUSHIKI KAISHA**
Tokyo 100 (JP)

(72) Inventor: **Ohno, Hisashi,**
c/o Mitsubishi Denki K.K.
Itami-shi, Hyogo 664 (JP)

(74) Representative: **Lehn, Werner, Dipl.-Ing. et al**
Hoffmann Eitle,
Patent- und Rechtsanwälte,
Postfach 81 04 20
81904 München (DE)

(56) References cited:
US-A- 4 446 475

- **ELEKTRONIK vol. 38, no. 25, 8 December 1989, MUNCHEN DE pages 66 - 78 K.SICKERT ET AL. 'Schlüsseltechnologie Mikroelektronik - 24. Teil: Von der kontaktbehafteten zur kontaktlosen Chipkarte'**
- **IBM TECHNICAL DISCLOSURE BULLETIN. vol. 32, no. 4A, September 1989, NEW YORK US pages 431-432 "Rigid dish smart card"**
- **pages 431 - 432 'Rigid dish smart card'**
- **"Chipkarten"*, K. Fletta, Dr. Alfred Hüthig Verlag, Heidelberg,1989,pages 54-60, 72, 103-106**
- **Hersteller-spezification SLE 4401K, siemens, Ausgabe 6/87, content page 1-7, page 2/7, 3/7, 4/87, 5/7, 6/7, 11/16**
- **Letter to Deutsche Bundespost dated 6/10/88, 2 pages**

EP 0 581 284 B2

Description

[0001] This invention relates to a manufacturing and testing method for a non-contact IC card. IC/A card is known from Elektronik, vol. 38, no. 25, 8 December 1989, pages 66-78. With such an IC card, data may be transmitted and received by using for example electromagnetic induction, electromagnetic coupling and microwave without being contacted from the outside. JP-A-1 263 094 discloses a contact IC card in which test terminals are provided for testing components of the IC chip.

[0002] A known non-contact IC card sealed with a mold resin such as a liquid crystalline polymer can be tested about each of mounted elements before molding, but after it is molded it can be tested only as a whole by a reader/writer or a tester which transmits and receives a data by using for example electromagnetic waves indirectly, without contacting.

[0003] Since a known non-contact IC card is tested only as a whole after molding, each function of an electronic circuit mounted therein or each electronic element mounted therein cannot be tested individually. It is therefore impossible to find individually each damaged function or electronic element which was damaged during molding.

[0004] Accordingly, the present invention aims to provide method of manufacturing and testing a non-contact IC card free from the above-discussed problems.

[0005] The present invention also seeks to provide a method in which each of the particular electronic elements and the functions of the electronic circuit mounted therein can be tested as to whether or not it is damaged after molding.

[0006] According to the present invention there is provided a method according to claim 1.

[0007] The present invention will become more readily apparent from the following detailed description of preferred embodiments of the present invention given by way of example and taken in conjunction with the accompanying drawings, in which:

Fig. 1 is a schematic sectional view of a non-contact IC card;
Fig. 2 is a schematic top plan view of the non-contact IC card illustrated in Fig. 1 but with the mold resin removed for clarity;
Fig. 3 is a schematic sectional view of the modified non-contact IC card illustrated in Fig.1 in which the testing pads are insulated from the outside by insulating means;
Fig. 4 is a schematic sectional view of another non-contact IC card;
Fig. 5 is a schematic sectional view of the modified non-contact IC card illustrated in Fig. 4 in which the testing pads are insulated from outside by insulating means;
Fig. 6 is a schematic sectional view of a non-contact IC card;
Fig. 7 is a schematic top plan view of the non-contact IC card illustrated in Fig. 6 but with the mold resin removed for clarity;
Fig. 8 is a cutting end view of the non-contact IC card illustrated in Fig. 6 after cutting off of the testing pads;
Fig. 9 is a perspective view of the non-contact IC card illustrated in Fig. 8;
Fig. 10 is a perspective view of the non-contact IC card illustrated in Fig. 8 in which the testing wires are insulated from outside by the resin;
Fig. 11 is a perspective view of the non-contact IC card illustrated in Fig. 9 while the testing wires are being insulated from outside by an insulating seal;
Fig. 12 is a perspective view of the non-contact IC card illustrated in Fig. 9 after insulated from the outside by the insulating seal;
Fig. 13 is a schematic sectional view of still another non-contact IC card;
Fig. 14 is a schematic top plan view of the non-contact IC card illustrated in Fig. 13 but with the mold resin removed for clarity;
Fig. 15 is a fragmented schematic enlarged top plan view of the non-contact IC card illustrated in Fig. 14 showing connecting portions between the testing pads and the testing wires;
Fig. 16 is a sectional view of the non-contact IC card taken along line A-A in Fig. 15; Fig. 17 is a cutting end view of the non-contact IC card illustrated in Fig. 13 after cutting off of the testing pads;
Fig. 18 is an enlarged schematic fragmented top plan view of still another non-contact IC card but with the mold resin removed for clarity; and
Fig. 19 is an enlarged top plan view of the fuse in the non-contact IC card illustrated in Fig. 18.

[0008] Fig. 1 illustrates a non-contact IC card and Fig. 2 is a schematic top plan view of the non-contact IC card illustrated in Fig. 1 but with a package of a mold resin removed for clarity. The non-contact IC card comprises a circuit board 10 and an electronic elements 12 mounted on a surface of the circuit board 10. The electronic elements 12 are electrically connected to each other through wire conductors 15 which are disposed on the circuit board 10 and a coil antenna pattern 13 is disposed on both of the surfaces of the circuit board 10. As best seen from Fig. 2, the outer-most circuit of a coil antenna pattern 13 is along the circumferential outer edge of the circuit board 10. The coil antenna pattern 13 is connected to the electronic elements 12. The antenna pattern 13 may be disposed only on one surface of the circuit board 10. When the antenna pattern 13 is disposed on both surfaces thereof, a number of turns of the antenna pattern 13 can be increased as compared with that of on only one surface. Thus, the wire conductors 15, the electronic elements 12 and the antenna pattern 13 compose an electronic circuit 9 having a plurality

of functions. The top surface (in Fig. 1) of the circuit board 10 is molded with a mold resin or-a package 14 such as liquid crystalline polymer together with the electronic circuit 9. Testing pads 11 through which the electronic element 12 orthe functions in the electronic circuit 9 is tested are attached to the bottom surface (in Fig. 1) of the circuit board 10 and are exposed outside. Each of the testing pads 11 is connected to the electronic elements 12 mounted on the top surface of the circuit board 10 through a plurality of testing wires 15a which extend through a plurality of through holes 16 which are formed in the circuit board 10.

[0009] Since the testing pads 11 connected to the electronic elements 12 which is completely molded by a mold resin are attached to the bottom surface of the circuit board 10, the testing pads 11 are not molded and are exposed outside even after the non-contact IC card was molded. Each of the electronic element 12 and each of the functions therefore can be tested easily by touching each of the testing pads 11 with a testing pin such as a tester. Thus, the testing wire conductors 8, each having one end connected to the electronic circuit 9 and the other end being the testing pad 11 and exposed outwardly from the mold resin 14, are composed of the testing wires 15a, the through holes 16 and the testing pads 11. Before the non-contact IC card is shipped, the testing pads 11 may be, if necessary, covered, as illustrated in Fig. 3, with insulating means 17 (See Fig. 11) which is an insulating film made for example of vinyl chloride resin to prevent an access from the outside. As shown in Fig. 2, the testing pads 11 are positioned on the bottom surface correspondingly to the position of the electronic elements 12 which are mounted on the top surface, the length of the testing wires 15a are therefore short and does not hinder the other wire conductors 15 of the electronic circuit 9.

[0010] Fig. 4 illustrates another non-contact IC card which has basically the same structure as that illustrated in Fig. 1 but is different in that both of the surfaces of a circuit board 10 are molded with a mold resin 24 such as liquid crystalline polymer except for the testing pads 11. So, the testing pads 11 are exposed outwardly. Each of electronic elements 12 and each of functions in an electronic circuit 9 can be tested through testing conductors 8 which are composed of the testing pads 11 and testing wire 15a electrically connecting the testing pads 11 and the electronic elements 12 together. After the test, the testing pads 11 may be burled in a resin 25 and insulated from the outside as illustrated in Fig. 5 to prevent an access from the outside and damage during shipping and storage. For the resin 25, for example, liquid crystalline polymer is suitable.

[0011] Figs. 6 and 7 illustrate a non-contact IC card which may be manufactured and tested according to an embodiment of the present invention and which has basically the same structure as that illustrated in Fig. 1 but is different in that the circuit board 10 comprises an extending portion 10a which extend in a cantilevered manner and exposed outwardly from the mold resin and a plurality of testing pads 31 are disposed on only the top surface of the extending portion 10a of the circuit board 10. The testing pads 31 are exposed outwardly from a mold resin 34 together with the extending portion 10a of the circuit board 10. For details, both of the surfaces of the circuit board 10 except the extending portion 10a are molded with the mold resin 34 such as liquid crystalline polymer. The testing pads 31 are electrically connected to electronic elements 12 mounted on the circuit board 10 through testing wires 15b which are disposed on the circuit board 10. Since a coil antenna pattern 33 is disposed on the bottom surface of the circuit board 10 and only a connecting portion of the antenna pattern 33 for connecting to the electronic elements 12 is drawn out through a through hole 36 to the top surface of the circuit board 10, the antenna pattern 33 therefore does not hinder the wire conductors 15 and the testing wires 15b. After the molding, data is input and output through only the antenna pattern 33 by using electromagnetic induction and microwaves without any contact with the non-contact IC card. Only a necessary number of the testing pads 31 for individually testing the function or the electronic elements 12 may be disposed. Alternatively, the testing pads 31 may be prepared in a standardized fixed number to simplify the manufacturing process, and only needed testing pads 31 among them are connected to the electronic elements 12 and used for the test as illustrated in Fig. 7.

[0012] The non-contact IC card as described above can be tested individually with respect to the individual elements 12 through the testing pads 31. After the test, the testing pads 31 are cut off along the phantom line 35 in Fig. 7 together with the extending portion 10a of the circuit board 10, and the cut end thereof is chamfered and fair-ed, whereby the cut ends of the testing wires 15b are exposed outside as illustrated in Figs. 8 and 9. In this state, since the data and memory in the inside of the non-contact IC card may happen to be read or broken from the cutting end of the testing wire 15b after assembly and shipment, the cut end of the non-contact IC card may be, if necessary, covered with the resin 38 such as liquid crystalline polymer completely, as illustrated in Fig. 10, to prevent the CPU and the memory from being electrically accessed from the outside. Alternatively, as illustrated in Fig. 11, the cut end and both surfaces of the non-contact IC card may be covered with a suitable insulating means such as an insulating seal 39 made for example of vinyl chloride resin to insulate from the outside. The insulating seal 39 has two leaves 39a placed on the circuit board and the mold resin and the insulating seal 39 completely wraps the surfaces of the non-contact IC card with the leaves 39a. As described above, the testing wire conductors 8 are composed of the testing wires 15b, the through holes 36 and the testing pads 31, and connected at one end thereof to the electronic circuit 9 and the other end of the testing wire conductors 8 is the testing pads 31

which is exposed from the mold resin 34. After testing, the other ends of the testing wire conductors 8 or the testing pads 31 are cut off together with the extending portion 10a of the circuit board 10 and the cut end thereof is covered with insulating means made of an insulating material. Therefore, the testing wire conductors 8 are insulated from the outside by the insulating means. In this non-contact IC card, since the testing pads 31 are positioned along a straight line, the testing process is easy and can be also automatical. As the electronic circuit 9 is protected by the mold resin 34 which integrally molds, this non-contact IC card is mechanically strong and durable.

[0013] Figs. 13 and 14 illustrate still another non-contact IC card which may also be manufactured and tested by an embodiment of the method of the present invention and which is suitable for use for example in the case that a relatively large number of electronic elements 12 are mounted on the circuit board 10 and a large number of testing pads 41 are needed, and which has basically the same structure as that illustrated in Figs. 6 and 7 but is different in that the testing pads 41 are disposed on both surfaces of an extending portion 10a of the circuit board 10. As illustrated in Fig. 13, the testing pads 41a are disposed on the top surface of the circuit board 10 and the testing pads 41 b are disposed on the bottom surface thereof, and the testing wires 15b which are connected to the testing pads 41 are pulled out to the top surface of the circuit board 10 through a plurality of through holes 36 and are connected to electronic elements 12 which are mounted on the top surface of the circuit board 10. The other structures are completely the same as that of Figs 6 and 7. As illustrated in Fig. 15, all the testing pads 41 are connected to the testing wires 15b to be used during test. In another way, as illustrated in Fig. 14, only the needed testing pads 41 among that prepared in a fixed number may be connected to be used during test. Further, in this case also, similarly to the embodiment illustrated in Figs. 6 and 7, the testing pads 41 are cut off together with the extending portion 10a of the circuit board 10 at the cutting portion 45 in Fig. 13 after each of the electronic elements 12 mounted on the circuit board 10 are tested individually through the testing pads 41. Fig. 17 is an end view of the cut end thereof, which shows that the testing wire conductors (15) are disposed alternately on the opposite major surfaces of the circuit board 10 such that each conductor 15b is located at a position on one major surface opposite to the space between two adjacent conductors on the opposite major surface. As seen from Fig. 17, since the testing wires 15b are exposed outside of the package, the cut ends may be insulated so as to be prevented from being electrically accessed from the outside by the same method as in the case above.

[0014] As illustrated in Fig. 15 and Fig. 16, the testing pads 41a mounted on the top surface of the circuit board 10 and the testing pads 41 b mounted on the bottom surface thereof may be overlapped in the perpendicular direction to the circuit board 10 (horizontally in the figures), however, the testing wires 15b which are mounted respectively on the top surface and the bottom surface should not be overlapped in the perpendicular direction to the circuit board 10. Because, if there are overlapped portions, when the testing pads 41 are cut off at a cutting portion 45 illustrated in Fig. 13 by cutting means having an electrically conductive metallic cutting edge (not shown), an electrical short-circuiting may occur between the testing testing wires 15b on the top surface and the testing wires 15b on the bottom surface through the metallic edge of the cutting means. When a cutting burr of the testing wire 15b on one surface may extend and connect to the testing wire 15b on the other surface thereof, the electrical short-circuiting may occur.

[0015] Figs. 18 and 19 illustrate still another non-contact IC card which may also be manufactured and tested by an embodiment of the method of the present invention and which has basically the same structure as that illustrated in Fig. 6 or that illustrated in Fig. 13. Different structure is that one portion of the testing wire conductor is formed into a fuse and the testing wire conductor is applied a high voltage from outside and burning off the fuse to be insulated from outside after testing.

[0016] Similarly to the cards illustrated in Figs. 6 and 13, the electronic elements 12 are mounted on a circuit board 10 and the circuit board 10 except the extending portion 10a of the circuit board 10 is molded with a mold resin such as liquid crystalline polymer. The extending portion 10a is exposed from the mold resin and extends outwardly in a canti-levered manner. On the bottom surface of the circuit board 10, the antenna pattern 33 is disposed. As illustrated in Fig. 18, the testing pads 51 are disposed on the extending portion 10a and are connected to the electronic elements 12 through testing wires 55 disposed on the circuit board 10. Each of the testing wires 55 forks into two branches near the testing pads 51 in the mold resin, and the fuse 56 which has a small cross-sectional area is formed at the fork portion in the testing wire 55, the two branches of the testing wire 55 are connected to two of the testing pads 51a and 51b at the outside of the mold resin. Fig. 19 is an enlarged view of the fuse 56. After the electronic elements 12 has been individually tested through the testing pad 51a or 51b, a terminal 57 for being applied a high voltage and a ground terminal 58 are respectively connected to the testing pads 51a and 51b. Then, a high voltage is applied to the terminal 57 until the fuse 56 is burnt off and the testing wire 55 is insulated from outside. Then, the testing pads 51 are cut off together with the extending part 10a of the circuit board 10. The fuse 56 which was burnt off by the high voltage provides a gap which insulates one end of the testing wire conductor 8 from the electronic circuit 9 and which functions as an insulating means for insulating the testing wire conductor 8. In this non-contact IC card, by using a high voltage, the testing wire conductor after testing can be insulated easily from outside and can be prevented from

being accessed from the outside.

[0017] As has been described, the method forms a plurality of testing wire conductors connected at one end thereof to an electronic circuit on a circuit board having a plurality of functions and exposed outside of a resin mold at the other end thereof for individually testing any desired functions of the electronic circuit. Therefore, the functions and/or electronic components of the molded electronic circuit can be individually tested, whereby the position of the faults or damages generated during the molding can be determined and a precise quality control can be achieved.

Claims

1. A method of manufacturing and testing a non-contact IC card, comprising the steps of:

   mounting an electronic circuit (9) having a plurality of functions on a circuit board (10) comprising an extending portion (10a) extending therefrom;
   providing a plurality of testing wire conductors (15b) on said circuit board (10) for individually testing said functions of said electronic circuit, said testing wire conductors (15b) each having one end connected to said electronic circuit (9) and the other end extending to a testing pad (31; 41a, 41b) disposed on said extending portion (10a) of said circuit board (10) so as to be accessible for said individual function test through a testing pad (31; 41a, 41b);
   forming a resin mold on said circuit board (10) to seal said electronic circuit (9) except for said other end of said testing wire conductors (15b) including said testing pads (31; 41a, 41b) on said extending portion (10a) extending outside said mold;
   testing said electronic circuit (9) with respect to said functions through said testing wire conductors (15b) including said testing pads (31; 41a, 41b); and
   when said functions have been tested, cutting off said extending portion (10a) including said testing pads (31; 41a, 41b) to thereby obtenir said non-contact IC card.

2. A method as claimed in claim 1, wherein, after said extending portion (10a) is cut off, the resulting exposed testing wire conductor ends are insulated from outside by insulating means (38; 39).

3. A method as claimed in claim 2, wherein said insulating means comprises an insulating sheet (39) disposed on both surfaces of said circuit board (10) and the cut end thereof to cover and insulate said exposed ends of said testing wird conductors (15b).

4. A method as claimed in claim 3, wherein said insulating sheet (39) has a fold folded along at least one side of said circuit board (10).

5. A method as claimed in claim 2, wherein a fuse (56) is disposed in each portion (55) of the testing wire conductors (51a, 51b) which is formed within said package and wherein, after the testing of said electronic circuit (9) and before cutting off said extending portion (10a), said fuse is burnt through by an applied high voltage to disconnect the portion of said testing wire conductor between said fuse and said other end of said testing wire conductor from the remainder of said testing wire conductor.

Patentansprüche

1. Ein Verfahren zum Herstellen und Testen einer kontaktfreien IC-Karte, die Schritte umfassend:

   Befestigen einer elektronischen Schaltung (9) mit einer Vielzahl von Funktionen auf einer Schaltplatte (10) mit einem Erweiterungsabschnitt (10a), der sich davon erstreckt;

   Bereitstellen einer Vielzahl von Testleitern (15b) auf der Schaltplatte (10), zum individuellen Testen der Funktionen der elektronischen Schaltung, wobei die Testleiter (15b) jeweils mit einem Ende mit der elektronischen Schaltung (9) verbunden sind, und das andere Ende sich zu einem Testkontakt (31; 41a, 41b) erstreckt, der auf dem Erweiterungsabschnitt (10a) der Schaltplatte (10) so angeordnet ist, dass er für einen individuellen Funktionstest durch einen Testanschluss (31; 41a, 41b) zugänglich ist;

   Bilden eines Gießharzes auf der Schaltplatte (10), um die elektronische Schaltung (9) mit Ausnahme des anderen Endes der Testleiter (15b) einschließlich der Testkontakte (31; 41a, 41b) auf dem sich von dem Harz nach außen erstreckenden Erweiterungsabschnitt (10a) abzudichten;

   Testen der elektronischen Schaltung (9) mit Bezug auf die Funktionen durch die Testleiter (15b) einschließlich der Testkontakte (31; 41a, 41b); und
   nachdem die Funktionen getestet worden sind, Abschneiden des Erweiterungsabschnitts (10a) einschließlich der Testkontakte (31; 41a, 41b), um dadurch die kontaktfreie IC-Karte zu erhalten.

2. Ein Verfahren nach Anspruch 1, wobei nach dem Abschneiden des Erweiterungsabschnitts (10a) die

resultierenden freiliegenden Testdrahtenden durch Isoliermittel (38; 39) von außen isoliert werden.

3. Ein Verfahren nach Anspruch 2, wobei die Isoliermittel eine Isolierschicht (39) umfassen, angeordnet auf beiden Oberflächen der Schaltplatte (10) und dem abgeschnittenen Ende davon, um die freiliegenden Enden der Testleiter (15b) abzudecken und zu isolieren.

4. Ein Verfahren nach Anspruch 3, wobei die Isolierschicht (39) eine Faltung aufweist, die entlang zumindest einer Seite der Schaltplatte (10) gefaltet ist.

5. Ein Verfahren nach Anspruch 1, wobei eine Sicherung (56) in einem jeweiligen Abschnitt (55) der Testleiter (51a, 51b) angeordnet ist, welcher innerhalb der Packung ausgebildet ist, und wobei nach dem Testen der elektronischen Schaltung (9) und vor einem Abschneiden des Erweiterungsabschnitts (10a) die Sicherung durch ein Anlegen einer Hochspannung durchgebrannt wird, um den Abschnitt der Testleiter zwischen der Sicherung und dem anderen Ende der Testleiter von dem Rest der Testleiter abzutrennen.

Revendications

1. Procédé de fabrication et d'essai d'une carte à circuit intégré sans contact, comprenant les étapes consistant à :

   monter un circuit électronique (9) ayant une pluralité de fonctions sur une carte imprimée (10) comprenant une portion d'extension (10a) s'étendant à partir de celle-ci ;
   fournir une pluralité de conducteurs de test (15b) sur ladite carte imprimée (10) pour tester individuellement lesdites fonctions dudit circuit électronique, lesdits conducteurs de test (15b) ayant chacun une extrémité connectée audit circuit électronique (9) et l'autre extrémité s'étendant à un plot de test (31;41a, 41b) disposé sur ladite portion d'extension (10a) de ladite carte imprimée (10) de manière à être accessible pour ledit test de fonction individuelle par un plot de test (31; 41a, 41b) ;
   former un moule en résine sur ladite carte imprimée (10) pour sceller ledit circuit électronique (9) à l'exception de ladite autre extrémité desdits conducteurs de test (15b) incluant lesdits plots de test (31; 41a, 41b) sur ladite portion d'extension (10a) s'étendant à l'extérieur dudit moule ;
   tester ledit circuit électronique (9) en ce qui concerne lesdites fonctions par lesdits conducteurs de test (15b) incluant lesdits plots de test (31; 41a, 41b) ; et
   lorsque lesdites fonctions ont été testées, couper ladite portion en extension (10a) incluant lesdits plots de test (31;41a, 41b) afin d'obtenir ainsi ladite carte à circuit intégré sans contact.

2. Procédé selon la revendication 1, dans lequel, après que ladite portion en extension (10a) a été coupée, les extrémités exposées résultantes des conducteurs de test sont isolées de l'extérieur par un moyen isolant (38 ; 39).

3. Procédé selon la revendication 2, dans lequel ledit moyen isolant comprend une feuille isolante (39) disposée sur les deux surfaces de ladite carte imprimée (10) et l'extrémité coupée de celle-ci afin de recouvrir et isoler lesdites extrémités exposées desdits conducteurs de test (15b).

4. Procédé selon la revendication 3, dans lequel ladite feuille isolante (39) comporte un pli longeant au moins un côté de ladite carte imprimée (10).

5. Procédé selon la revendication 1, dans lequel un fusible (56) est disposé dans chaque portion (55) des conducteurs de test (51a, 51b) qui est formée à l'intérieur dudit boîtier et dans lequel, après le test dudit circuit électronique (9) et avant que la partie en extension (10a) soit coupée, ledit fusible est grillé par l'application d'une haute tension afin de déconnecter la portion dudit conducteur de test entre ledit fusible et ladite autre extrémité dudit conducteur de test du reste dudit conducteur de test.

FIG. 1

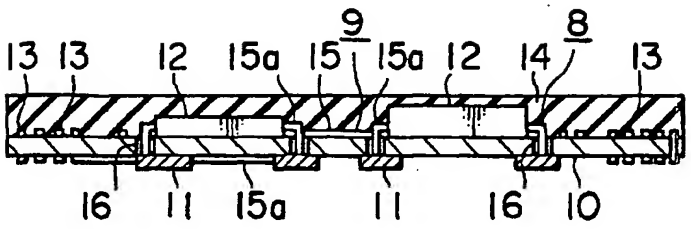

FIG. 2

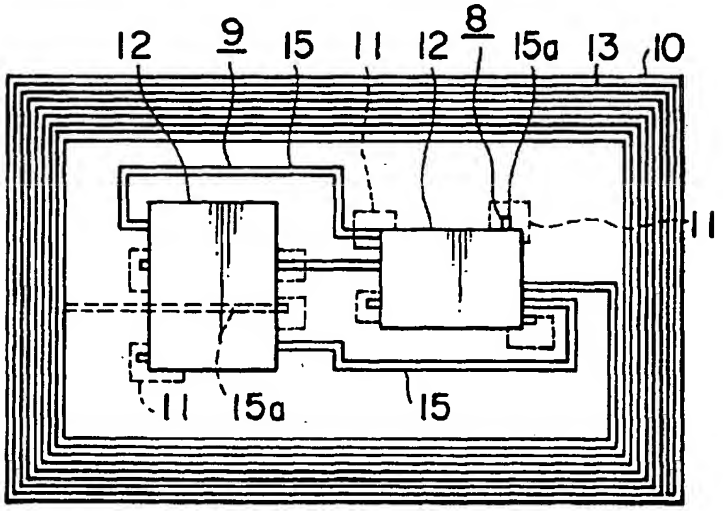

FIG. 3

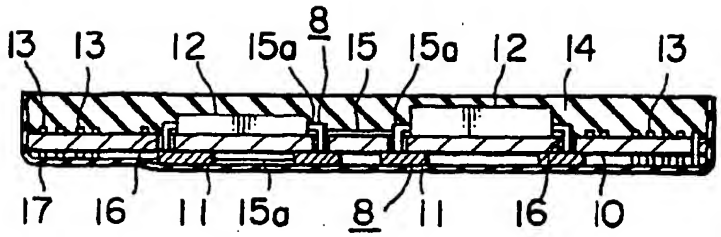

FIG. 4

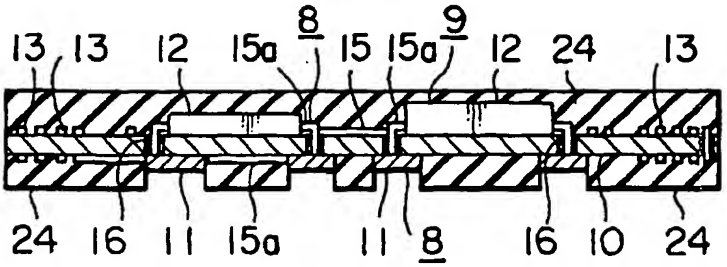

FIG. 5

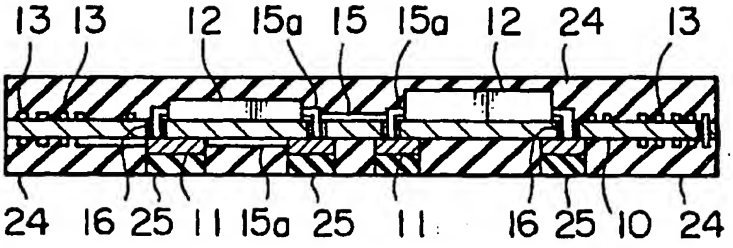

FIG. 6

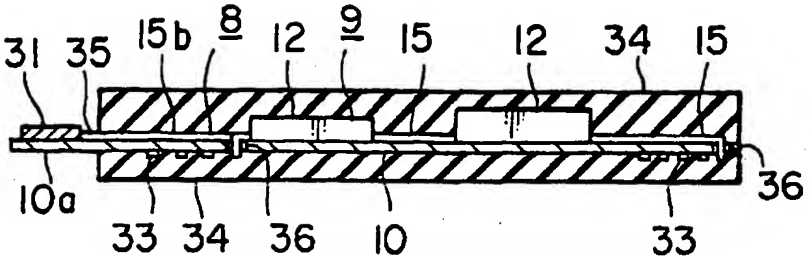

FIG. 7

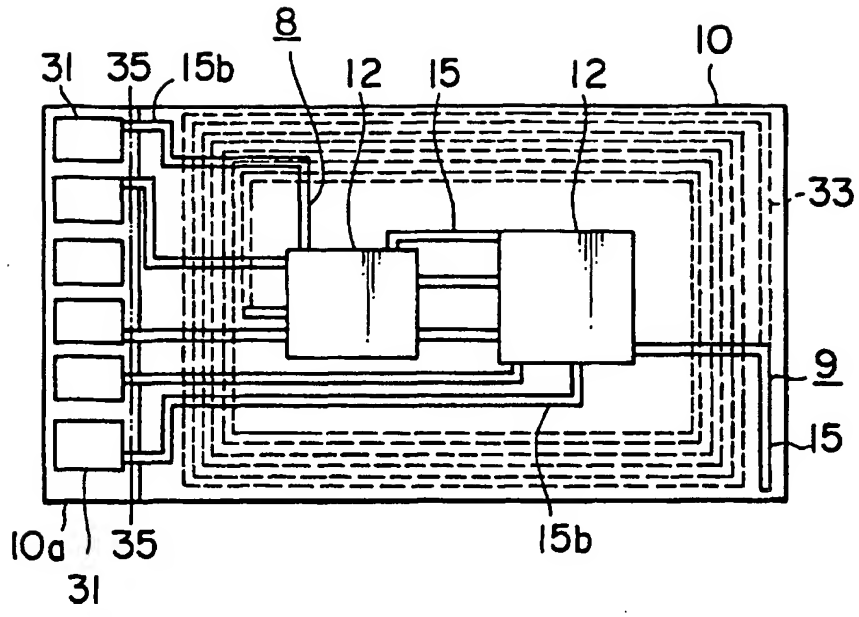

FIG. 8

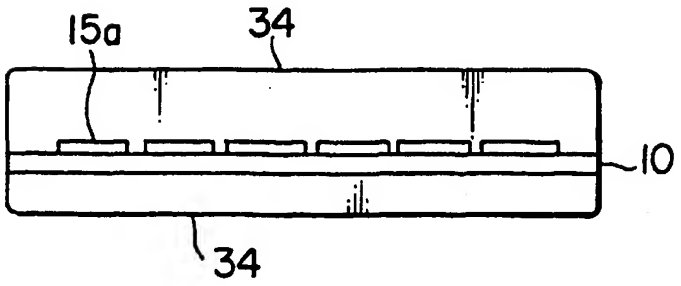

FIG. 9

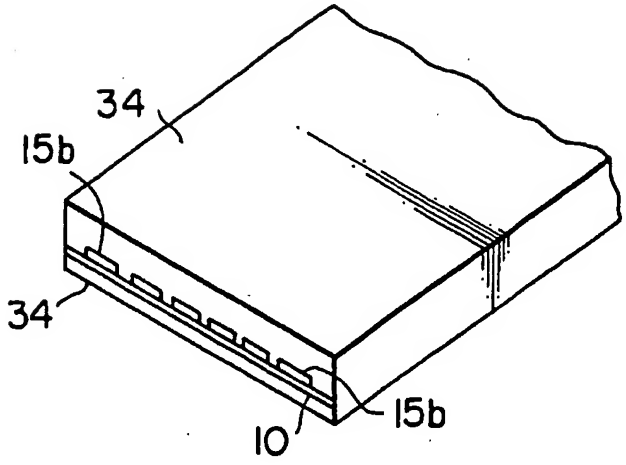

FIG. 10

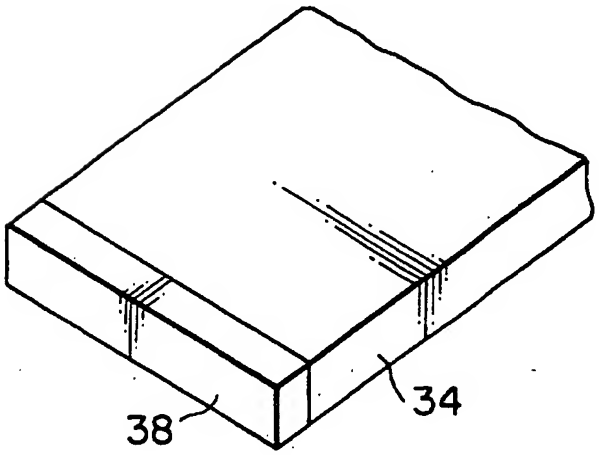

FIG. 11

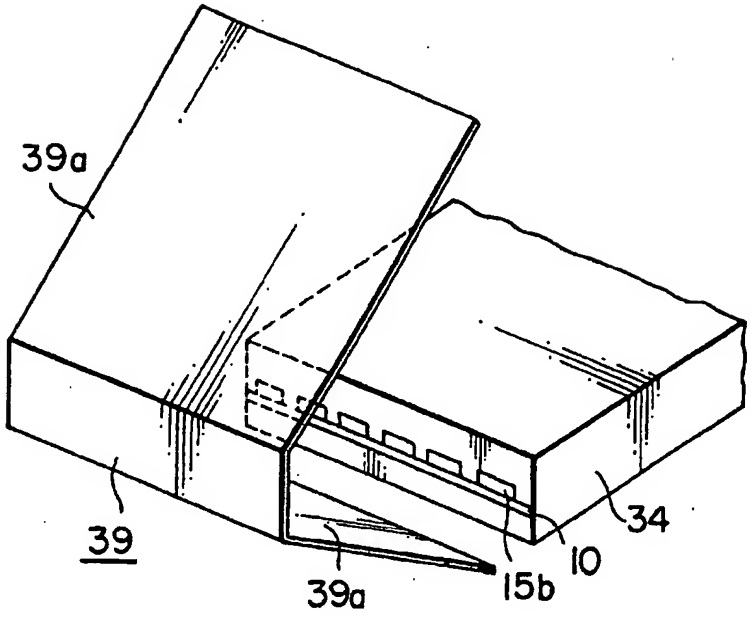

FIG. 12

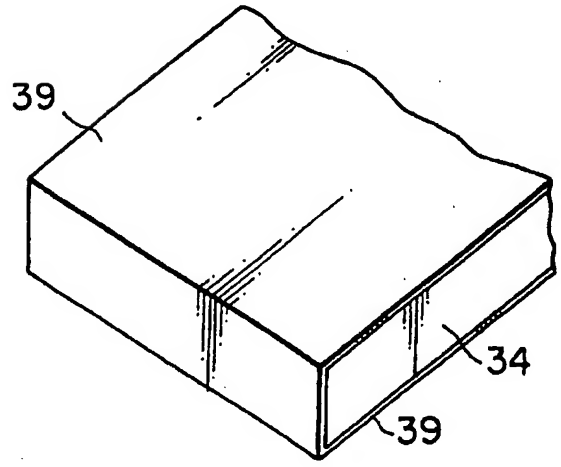

FIG. 13

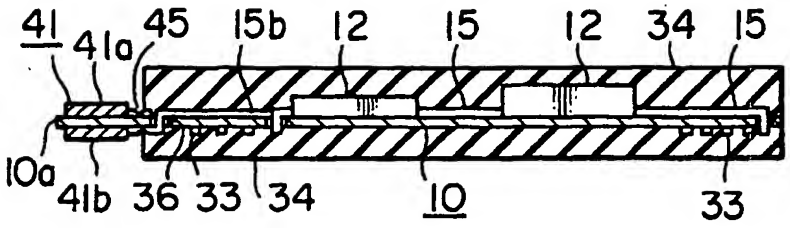
41
41a
45
15b
12
15
12
34
15
10a
41b
36
33
34
10
33

FIG. 14

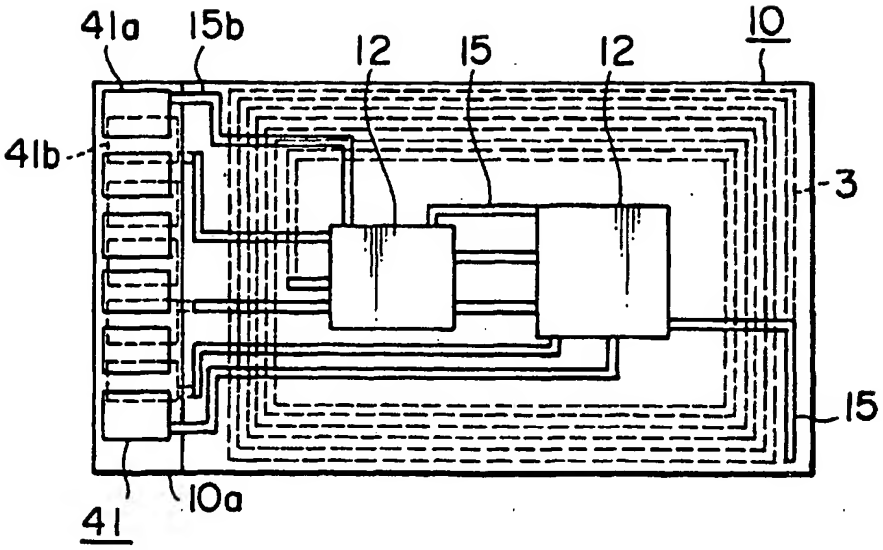
41a
15b
12
15
12
10
41b
3
15
41
10a

FIG. 15

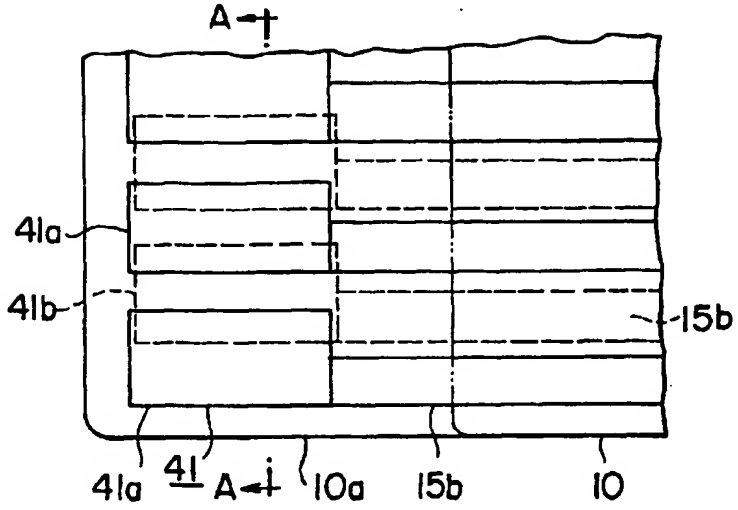

FIG. 16

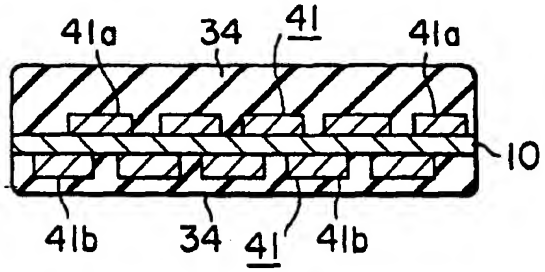

FIG. 17

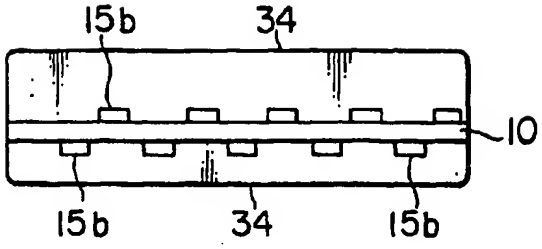

FIG. 18

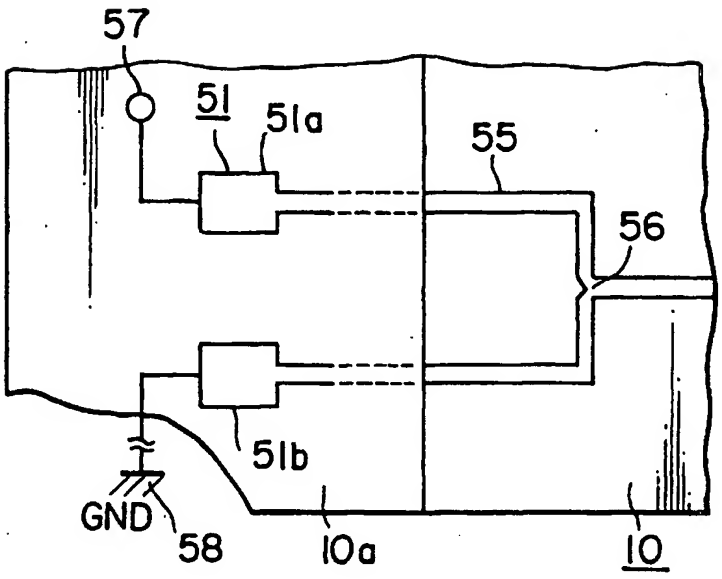

FIG. 19